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**INVESTIGATION OF ELI TWIST PROPERTIES IN
COMPARISON WITH TFO YARNS**

PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project report "INVESTIGATION OF ELI TWIST YARN PROPERTIES IN COMPARISION WITH TFO YARNS" is the bonafide work of V.J KUMAAR who carried out the project work under my supervision during the year 2010-2011.


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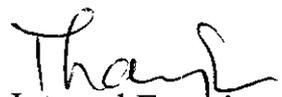
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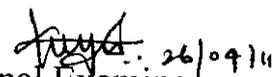
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External Examiner

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ABSTRACT

The need based yarn quality in the spinning process has undergone significant improvement. The compact spinning system is one other pioneer step towards the same, the fibre flow is laterally compacted by metered aerodynamic forces resulting in the very narrow spinning triangle. In addition to produce the single compact yarn, the technology has extended the application for the double yarn spinning also in the ring frame itself with manifold advantage over the conventional double yarn production.

The Eli Twist yarn has better strength and elongation values, lower hairiness values, marginally better imperfection level and higher productivity.

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CHAPTER 1

INTRODUCTION

Two ply folded yarns find its applications in various fields like garment and home textiles. In the present scenario, raw materials occupy 60 to 65% of manufacturing cost of yarn. The conventionally available for producing doubled yarns through Two-For-One twister/Ring doubler involves labour, low productivity and number of intermediate machineries. It has been the dream of the spinners to produce such double yarns at spinning itself, with the invention of EliTwist, the possibility of producing two ply yarns in spinning has gained more commercial value.

The extremely cost effective application of this spinning process on existing spinning frames with the Elite compact set emphasises the high flexibility of the Elite process.

The Elitwist compact yarns (two ply) has many advantages in the downstream process. The Elitwist yarns are attributed by their increased yarn strength, increased work capacity, reduced hairiness and reduced abrasion.

CHAPTER 2

OBJECTIVES OF THE PROJECT

- To manufacture doubled yarns in spinning machine itself in retrofitted ring frame with Elitwist compact set.
- To analyse and compare the yarns manufactured from Elitwist and TFO Doubled yarns for the yarn quality improvement.
- To find out the Techno-economics of the yarns manufacturing process by comparing the Elitwist and TFO doubled yarns.

CHAPTER 3

LITERATURE REVIEW

3.1 NEED FOR DEVELOPMENT:

The method of twisting two or more single yarns is called “Doubling or Two-folding” or “Ply-twisting”, such yarns are called as doubled yarns, folded yarns or plied yarns and machinery intended for the purpose are called doublers or ply-twisters. It is estimated that today between 20-25% of all ring spun yarns are plied before the end use.

Since TFO produces long lengths of knot-free yarns problems like knot-slippage in weaving preparatory/weaving, value-loss in fabric due to prominent appearance of knots are minimised while using TFO twisted yarns. Hence, TFO is becoming more and more popular particularly so in export oriented mills.

Improvement in yarn quality due to doubling are:

- CSP of doubled yarn in relation to single yarns is higher by about 10% in $20^s/30^s$, 15% in 40^s and 60^s 25% in $80^s/100^s$. the strength improvement form doubling would be higher for material having higher variability. Since strength CV is more finer yarns, strength improvement due to doubling will also be higher for fine yarns.
- Lea count CV improves by 0.5% and lea strength CV by 1.0%.
- Single yarn strength CV improves by about 20% due to doubling.
- Twist CV also improves by doubling by 20 to 40% (single yarn twist CV around 5 to 6% doubled yarn twist CV around 4%)

- Due to doubling yarn hairiness decreases to an extent of 60 to 80% in difference counts. Because of this doubled yarns not be signed. (Singeing is a process used for removing protruding hairs in the yarns).
- After doubling the yarn irregularity improves by $\sqrt{2}$ times the corresponding single yarns. The various yarn imperfection reduced by 75 to 90%, 90% in the case of coarse/medium counts and about 75% in fine counts. The marginal reduction in the extent of improvement in imperfections after doubling (while using TFO) in fine counts is attributed to the higher fibre loss due to air drag in yarn balloon. This can be confirmed by comparing yarn realisation between coarse/medium counts and fine counts and yarn realisation should be calculated from the weight of the feed of TFO yarn to that of delivered yarn.
- In the case of classimat 3 faults, both drafting faults and objectionable faults are reduced by 70 to 90% after doubling.

Since TFO machines involve number of preparatory machineries like Cheese winding/Assembly winding and the TFO yarns require to be rewound after doubling, it requires not only more labour force, but also the higher power consumption. In order to overcome the number of process, Elitwist spinning method has been developed. This method is based on the production of doubled yarns in spinning machine itself.

3.2 TWO PLY YARN IN RING SPINNING MACHINE:

The Elite system is practically independent of the basic ring spinning machine, and can be fitted on many different models. SUESSEN supplies everything, which is needed to upgrade a conventional ring spinning frame, but also not more than is needed.

The Eli Tube is attached at the exit of the conventional drafting system, it has one inclined slot for every spinning position, which is covered by lattice apron. The lattice apron is driven by the Eli top. The Eli tube is attached to the vacuum source, which is fitted under the machine. Each suction pump supplies 24 spinning positions. Hence the vacuum is completely uniform along the machine and independent of the length of the machine. All vacuum pumps are driven by a central draft, which in turn is driven by one or two electrical motors. The amount of vacuum can be adjusted.

SUESSEN is a company specializing in spinning technology open end rotor spinning their latest achievements in ring spinning are Eli Twist and Eli cone Twist with Eli Twist our customer produce two ply yarns directly on their ring spinning machine with compact spinning technology, setting new quality standards in the field of compact spinning.

The yarn result are much superior to double yarn and our customers are getting 2.5 times production in ring frame apart from avoiding of doubling, TFO and double production in winding with commercial applications ranging from Ne6/1 to Ne220/1, in all kinds of fibres, the SUESSEN Elite compact spinning system is the most versatile compacting system available.

The quality with SUESSEN EliTe yarn is generally superior to competing systems, not only in the compact yarn but even more in the finished final textile product.

3.3 ELI TWIST COMPACT SPINNING SYSTEM:

The elimination of the spinning triangle by incorporating a condensing zone after the drafting system has opened up new interesting prospects to ring spinning. While the first attempts of the new compacting methods were restricted in practice to fine weaving yarns of combed cotton, there is now hardly any important yarn sector which has not been infiltrated by compact yarns. The EliTe process with its unsurpassed flexibility has played an essential role in this development.

The purpose of this article is to present another variant developed for this process, which allows the very efficient production of two-ply compact yarn for superior demands directly on the ring spinning frame. EliTwist even improves the utilization of fibre substance further. This fact and the attractive structure of such yarns simultaneously offer new aspects for the production of core yarns and special-purpose yarns.

Production of two-ply on the ring spinning frame:

In order to spin two-ply yarn directly on the ring spinning frame, two fibre strands drafted parallel at a relatively large distance must be combined in a twisting point after passing the front roller pair of the drafting system. The speciality of such yarns is that the direction of twist in both legs is the same as in the resulting two-ply yarn. Well-known processes are SIROSPUN and DUOSPUN. From the twisting point, the twist spreads out in both yarn legs, each of which forms a long spinning triangle at the front roller pair of the drafting system due to the high yarn tension on the one hand and to the low twist on the other hand. The dimension of the twisting triangle depends on the distance of the twisting point Z from the nip point of the front roller pair and the distance A of the two emerging fibre strands. Point Z is the closer to the nip point, the

lower is the spinning tension and the closer is the distance A of the two fibre strands. It is obvious that only a very small twisting triangle allows a high spinning stability.

The number of turns per metre produced in the two yarn legs up to the nip point is about 20% lower than the twist of the yarn after the twisting point. In other words, the twist coefficient of the two yarn legs is only about half as high as in the final two-ply yarn. In this respect, detailed theoretical and experimental investigation has been made.

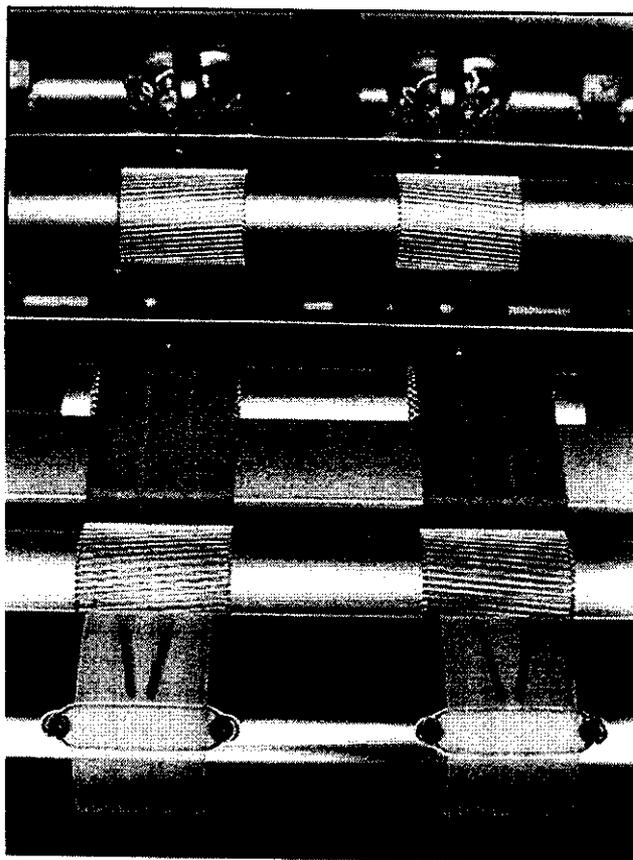


Figure 1 : Eli Twist Formation

Fibre loss at the drafting system exit is very high due to the very low twist in the two yarn legs. There is also a risk that if one strand breaks, only one component runs onto the bobbin. Even with yarn detectors at the twisting triangle, conventional methods of producing two-fold like yarn are therefore not able to achieve the high spindle speeds in short-staple spinning usual today.

Principle of EliTwist method:

The patented EliTwist process allows reducing the twisting triangle to a degree that the restrictions mentioned above are eliminated. This is realized by the two fibre strands first passing a condensing zone. During condensing, both components get closer and reach a minimum distance by means of two suction slots in the condensing zone in a V-shaped arrangement.

Owing to condensing, the two components-after leaving the condensing zone-do not form spinning triangles. Consequently, no fibres are sticking out, spreading up to the other yarn component or not being embedded in the yarn. The twist, running into the two yarn legs form the twisting point, need not overcome any resistance and easily reaches the clamping line.

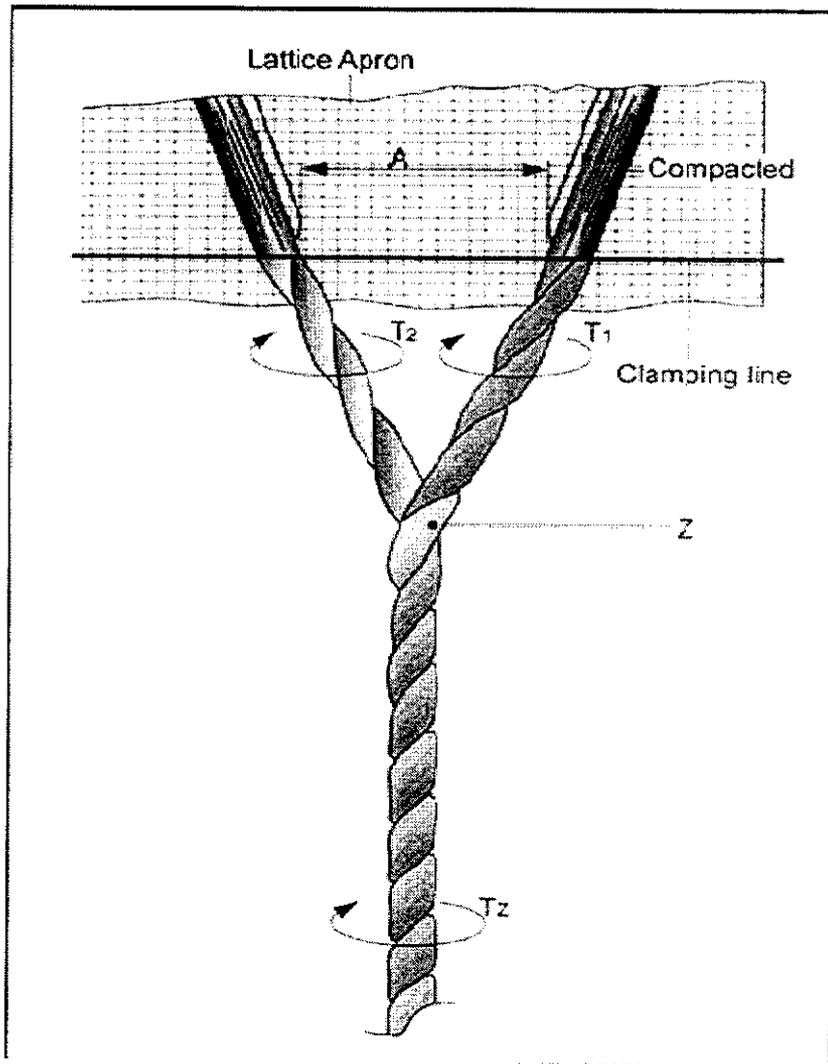


Figure 2 : Principle of Eli Twist Yarn

The twist, running into the two yarn legs form the twisting point, need not overcome any resistance and easily reaches the clamping line.

As a result, the two fibre strands can be led very closely and the twisting point has a very small distance from the clamping line of the front roller pair. In short-staple spinning, this distance is only between 4 and 5 mm, depending on the spinning tension. Both Siro and EliTwist yarns have the same count and analogous yarn and spinning parameters. The substantial fibre fly of the conventional Siro yarn can clearly be seen, whereas in EliTwist all fibres are safely embedded. This difference is also visible, when fibre loss at the suction tubes is measured.

In reality, fibre loss in conventional spin-twisting is even much higher, if we take in to account the fibre dust in the ambient air. The EliTwist process produces yarn with a novel structure combining all advantages of condensing and doubling. Yarn surface and appearance of EliTwist are comparable to a single compact yarn. If possible at all, its surface is even more clearly structured and closed. However, as the twist in the two yarn legs is identical, EliTwist has more snarling tendency.

For industrial practice an essential advantage of EliTwist over all conventional spin-twisting methods is that no detection devices are required for the twisting triangle. In case of a short term material interruption at one of the two components, the broken component will piece up automatically due to the prevailing geometrical conditions.

A refined variant of this method offers the possibility of feeding a filament in the centre of the twisting triangle, i.e directly at the twisting point. This allows a perfect covering of the yarn core. But it is also possible to feed additional threads parallel to one or both yarn legs.



Spinning results:

The running properties are excellent. There is no difference or even restriction in comparison with EliTe single yarn as regards possible traveller speeds. Two test series were realized with long staple cotton, comparing EliTwist with twisted yarns and with single yarns.

Test series A: comparison of

- EliTwist Ne60/2 and Ne 100/2 with 2-for-1 twisted ring yarn Ne 60/2 and Ne 100/2.
- 2-for-1 twisted EliTe yaen Ne 60/2 and 100/2.
- Siro Ne 60/2 and Ne 100/2.
- EliTwist Ne 60/2 and ring yarn Ne 30 and EliTe yarn Ne 30.

The most important results are summarized here:

The twist coefficient of all yarns types was in the range $ae=4.6$ to 3.3. The clear superiority of EliTwist in all important yarn parameters is confirmed. When comparing the twisted yarns, it soon became obvious that Siro-spun yarns cannot be produced any more with a twist coefficient-lower than 3.95. the spinning of one yarn Ne 100/2 with $ae=4.3$ even had to be discontinued. In this respect, EliTwist properties are similar to conventionally twisted ring spun or Elite yarn. The extremely good utilization of fibre substance of the EliTwist process offers clear advantages in yarn strength all through the tested yarn twist range, and they are even clearer the finer the yarn count.

This advantage is reflected by all yarn strength parameters like work capacity, elongation, minimum breaking load and breaking load and breaking load variation. When comparing hairiness, EliTwist generally has better values.

Since the appearance of EliTwist resembles to a single compact yarn, test series B compared EliTwist with some corresponding singles yarns. In this comparison, the EliTwist advantages in all yarn parameters are even more striking. In addition to improved yarn strength and hairiness parameters, the doubling effect has an additional positive effect. This is particularly visible in improved USTER irregularity and imperfections values, which should not be neglected.

3.4 ELI TWIST YARN PROPERTIES:

- Very smooth structure, closed yarn surface, circular yarn cross-section.
- High regularity.
- Considerably reduced fibre loss at the drafting system front roller pair.
- Extremely low hairiness, especially of long fibres (S3, >3mm).
- High breaking load and elongation, maximum work capacity.
- Very high yarn slippage and abrasion resistance.
- Very low pilling tendency.
- Low twist coefficients.
- Unrestricted traveller speeds.
- Manufacturing costs reduced up to about 50% compared with conventional twisted yarn.
- Saving or even elimination of sizing agent in most applications.
- No restriction in splicing.

The EliTwist spinning method combines compact spinning and twisting of a yarn in one single operation.

The specific yarn structure provides for the typical characters of EliTwist yarns, which are responsible for the very good processing properties:

- Superior yarn strength and maximum work capacity owing to excellent fibre substance utilization.
- Very good yarn evenness as a result of doubling.
- Circular, compact yarn cross-section.
- Extremely low hairiness values.
- Smooth yarn surface.
- Good abrasion resistance.
- High resistance to yarn slippage.
- Both yarn legs of the two-ply yarn with identical direction of twist.

EliTwist yarns can be produced in a most cost-effective way:

- Compact spinning and twisting in one operation.
- Significant production increase on ring spinning and winding machine.
- Doubling and twisting are saved.
- Spindle speed and ends-down achieve the level of single compact yarns spun in the same yarn count.

3.5 AREAS OF APPLICATION:

Principally no restriction regarding raw materials; fibre blends are also possible.

High-grade shirts and trouser fabrics.

Light gabardine fabrics.

Increasingly used for knitwear.

Special two-ply yarns with high strength.

Industrial fabrics.

CHAPTER 4

MATERIALS AND METHODS

S6 and MCU5 cottons were spun into the single yarn counts of Ne 20^s, Ne 40^s, Ne 60^s and Ne 80^s. The cotton yarn properties are shown in Table.1.

TABLE 1 : FIBRE PROPERTIES

S.NO	PROPERTIES	100% COTTON	
		S6	MCU5
1	2.5 span length (mm)	28.6	31.46
2	Fibre micronaire ($\mu\text{g}/\text{inch}$)	4.7	4
3	Maturity	0.87	0.86
4	Breaking tenacity (g/tex)	23.0	24.7
5	Breaking extension (%)	5.8	5.4

Four counts (cotton) namely 2/20^s Ne, 2/40^s Ne, 2/60^s Ne and 2/80^s Ne were taken for the study. All the single yarns were converted into doubled (two ply) yarns in TFO and the EliTwist spinning machine.

Lap was made on Trutzschler Blow room line and carded on DK 740 cards. The conversion to combed sliver was carried out by using sliver lap/Ribbon lap machines and comber LK54 of lakshmi. The stock from the combing unit was drawn in Rieter RSB851 draw frame and the slivers were converted into yarns of the desired count in Elitwist and in TFO double yarns.

4.1 METHODOLOGY

ELITWIST YARN

COTTON	COUNT	TWIST MULTIPLIER
S6	2/20 ^S ,2/40 ^S	3.0,3.4,3.8
MCU5	2/60 ^S , 2/80 ^S	3.0,3.4,3.8

TFO YARN

COTTON	COUNT	TWIST RATIO
S6	2/20 ^S ,2/40 ^S	0.70, 0.75, 0.80
MCU5	2/60 ^S , 2/80 ^S	0.70, 0.75, 0.80

Machinery and Process Details are as follows:

1. BLOW ROOM

Make	: Trutzschler
Lap Hank	
60s and 80s	: 0.0020
20s and 40s	: 0.0014

2. CARDING

Make	: Trutzschler DK 740
Card sliver hank	
60s and 80s	: 0.20
20s and 40s	: 0.14

Delivery speed (mpm)

60s and 80s	:	80
20s and 40s	:	100

3. COMBER

Make : **Lakashmi LK 54**

Nips/min : **350**

Comber sliver hank

60s and 80s : **0.20**

20s and 40s : **0.14**

Comber noil (%)

60s and 80s	}	:	18%
20s and 40s			

4. DRAW FRAME

Make : **Rieter RSB 851**

Delivery speed (mpm) : **350**

Finisher drawing sliver hank

60s and 80s : **0.20**

20s and 40s : **0.14**

Total number of doublings : **8**

5. SPEED FRAME

Make	:	Lakshmi LFS 1660
Spindle speed (rpm)	:	1000
Roving hank		
60s and 80s	:	2.60
20s and 40s	:	1.60
Break draft employed	:	1.19
TM applied		
60s and 80s	:	1.09
20s and 40s	:	1.15

6. RING FRAME

Male	:	Lakshmi Rieter G5/1
Cradle type	:	Short
Break draft	:	1.14
Back zone setting (mm)		
60s and 80s	}	
20s and 40s		
	:	60
Spindle Speed (rpm)		
60s and 80s	:	16500
20s and 40s	:	15000
TM employed		
60s and 80s	}	
20s and 40s		
	:	3.0, 3.4, 3.8

7. TFO

Make : **Veejay Lakshmi HS 150**

Spindle speed : **11500**

Twist ratio employed

60s and 80s

20s and 40s

}

: **0.7, 0.75, 0.80**

4.2 TESTING OF YARN PROPERTIES

- Yarn evenness (U%)
- Total imperfection level (TI).
- Uster hairiness (H value).
- Zweigle hairiness (S₃).
- Tensile strength and elongation.
- Yarn friction (μ).

CHAPTER 5

RESULTS AND DISCUSSION

TABLE 2 : 2/20S C ELITWIST AND TFO YARNS

Particulars	Twist Multiplier Of Elitwist Yarn			Twist Ratio of TFO yarn		
	3.0	3.4	3.8	0.70	0.75	0.80
U%	7.31	7.04	7.4	7.36	7.40	7.43
Imperfections/km	16.0	18.0	16.0	18.0	20.0	19.0
Uster Hairiness (H)	5.99	6.05	5.67	8.23	8.14	8.01
Zweigle Hairiness (S3)	1220	1200	1240	1328	1310	1321
Elongation (%)	7.57	8.28	8.75	6.54	7.08	6.25
Single Yarn Strength (Rkm)	20.46	21.21	20.58	19.20	19.80	19.42
Friction (μ)	0.23	0.22	0.21	0.24	0.23	0.23

TABLE 3 : 2/40s C ELITWIST AND TFO YARNS

Particulars	Twist Multiplier Of Elitwist Yarn			Twist Ratio of TFO yarn		
	3.0	3.4	3.8	0.70	0.75	0.80
U%	8.47	8.41	8.48	8.6	8.52	8.62
Imperfections/km	7.0	12.0	20.0	12.0	16.0	18.0
Uster Hairiness (H)	4.57	4.65	4.63	7.02	7.24	7.16
Zweigle Hairiness (S3)	820.2	840.4	818.6	1050.2	1100.6	1112.8
Elongation (%)	6.11	6.96	7.66	6.10	6.30	6.48
Single Yarn Strength (Rkm)	19.82	20.48	20.39	18.5	19.0	18.82
Friction (μ)	0.23	0.23	0.24	0.21	0.21	0.22

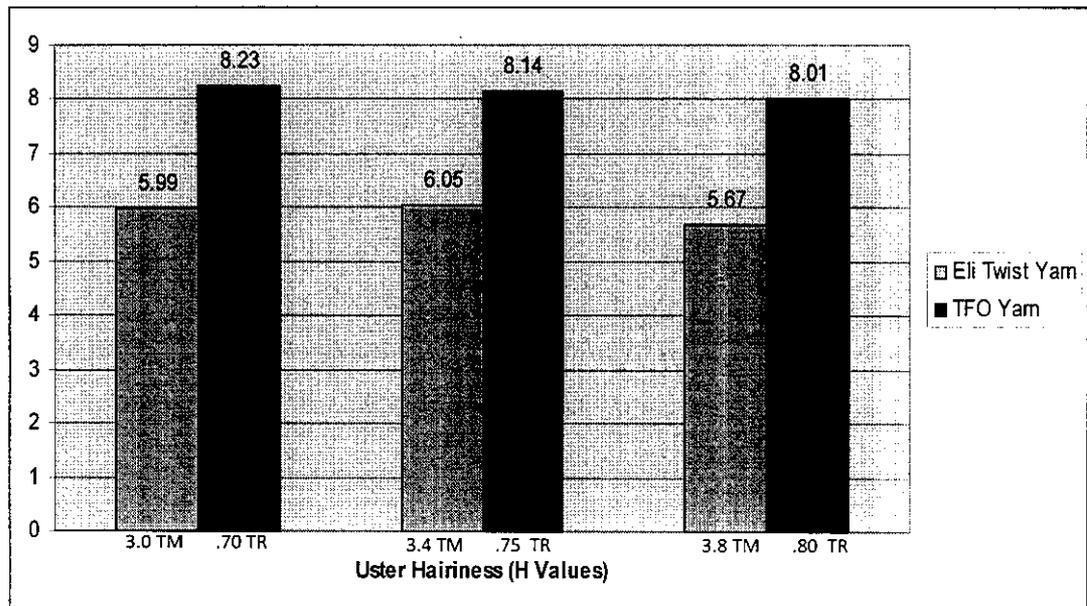
TABLE 4 : 2/60s C ELITWIST AND TFO YARNS

Particulars	Twist Multiplier Of Elitwist Yarn			Twist Ratio of TFO yarn		
	3.0	3.4	3.8	0.70	0.75	0.80
U%	8.97	9.0	8.98	8.4	8.5	8.3
Imperfections/km	21.0	23.0	22.0	19.0	21.0	20.0
Uster Hairiness (H)	3.49	3.52	3.67	5.61	5.53	5.30
Zweigle Hairiness (S3)	422.1	531.7	616.2	715.05	721.9	662.3
Elongation (%)	6.98	7.70	8.36	6.22	6.23	6.78
Single Yarn Strength (Rkm)	21.29	21.35	21.28	19.48	19.16	20.24
Friction (μ)	0.24	0.26	0.26	0.25	0.25	0.22

TABLE 5 : 2/80s C ELITWIST AND TFO YARNS

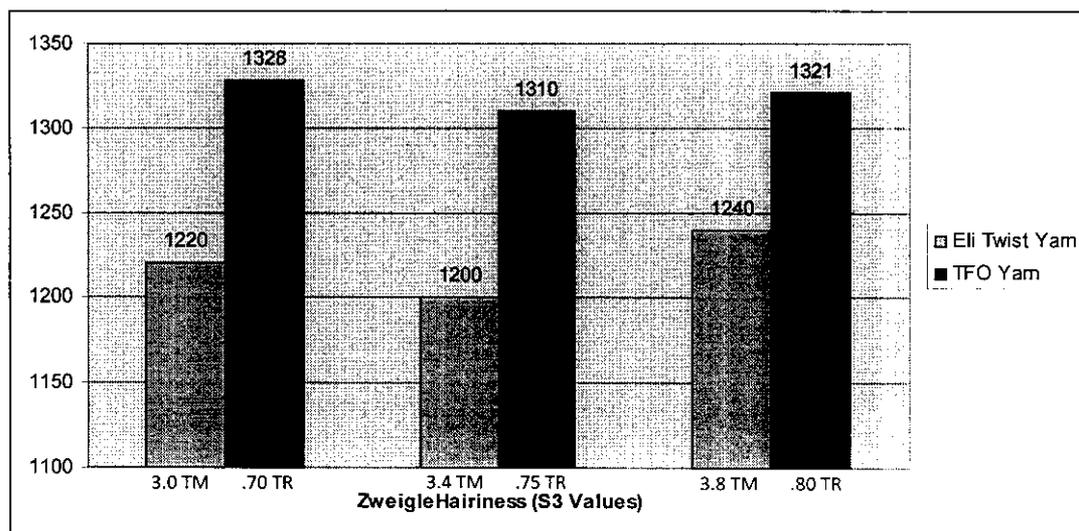
Particulars	Twist Multiplier Of Elitwist Yarn			Twist Ratio of TFO yarn		
	3.0	3.4	3.8	0.70	0.75	0.80
U%	9.83	9.83	9.64	9.47	9.35	9.80
Imperfections/km	50.0	51.0	43.0	52.0	48.0	54.0
Uster Hairiness (H)	3.17	3.08	3.01	5.34	5.15	4.52
Zweigle Hairiness (S3)	399.7	375.7	489.30	602.1	529.0	648.2
Elongation (%)	6.31	6.97	7.43	5.30	5.61	5.51
Single Yarn Strength (Rkm)	19.60	20.30	20.45	17.28	18.0	18.25
Friction (μ)	0.23	0.23	0.26	0.23	0.23	0.24

Figure 3 : 2/20s Uster Hairiness (H Value) of Eli Twist and TFO Yarns

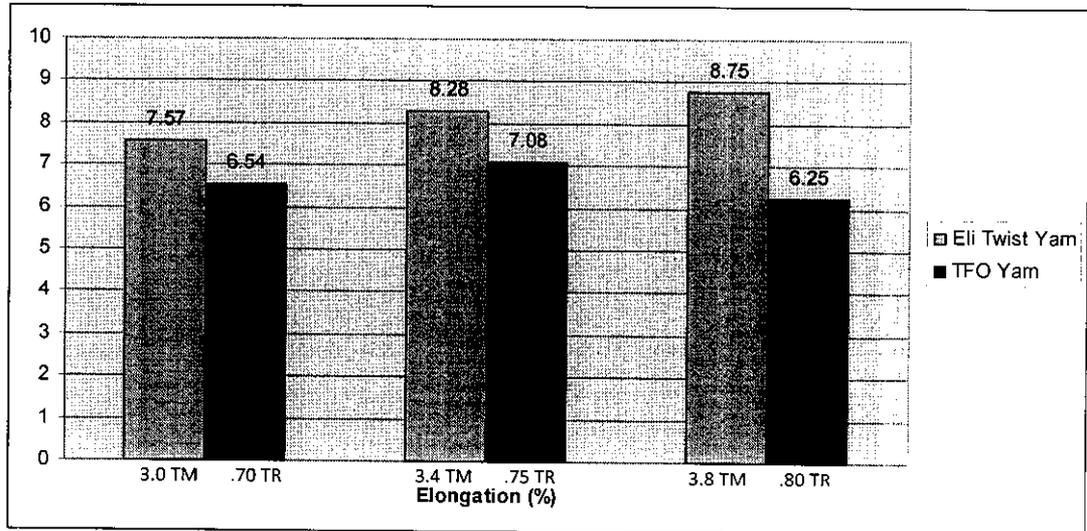


Uster Hairiness(H) of Eli Twist doubled yarns are better by 25-29% compare to TFO doubled yarns

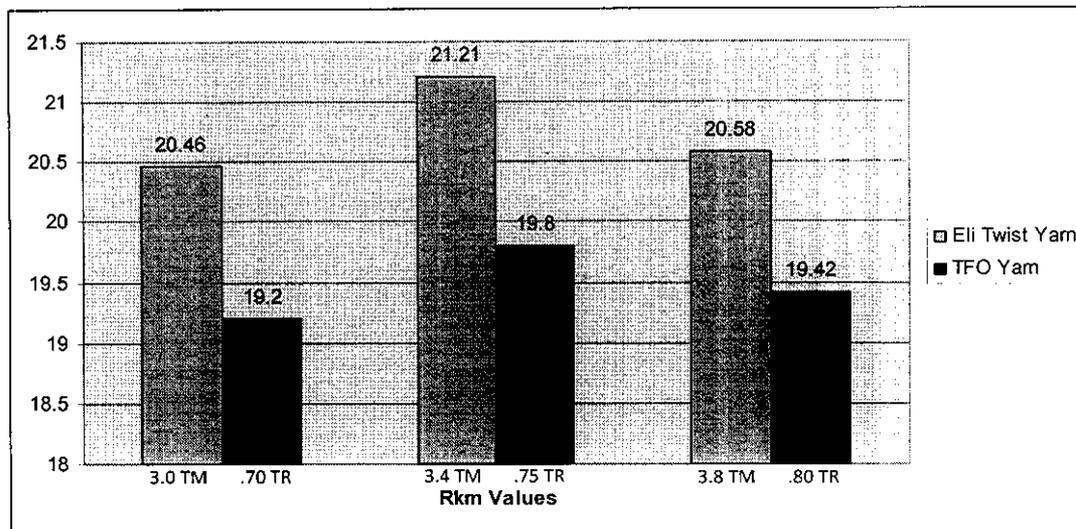
Figure 4 : 2/20s Zweigle Hairiness (S3 Value) of Eli Twist and TFO Yarns



Zweigle Hairiness(S3 Value) of Eli Twist doubled yarns are better by 6-8% compare to TFO doubled yarns

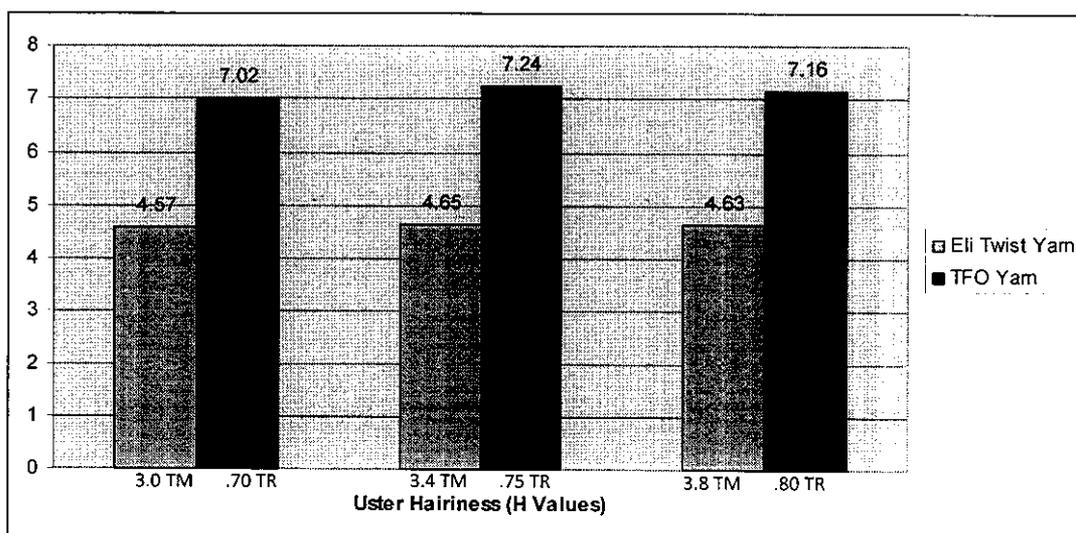
Figure 5 : 2/20s Elongation (%) of Eli Twist and TFO Yarns

Elongation (%) values of Eli Twist doubled yarns are higher by 6-14% compare to TFO doubled yarns

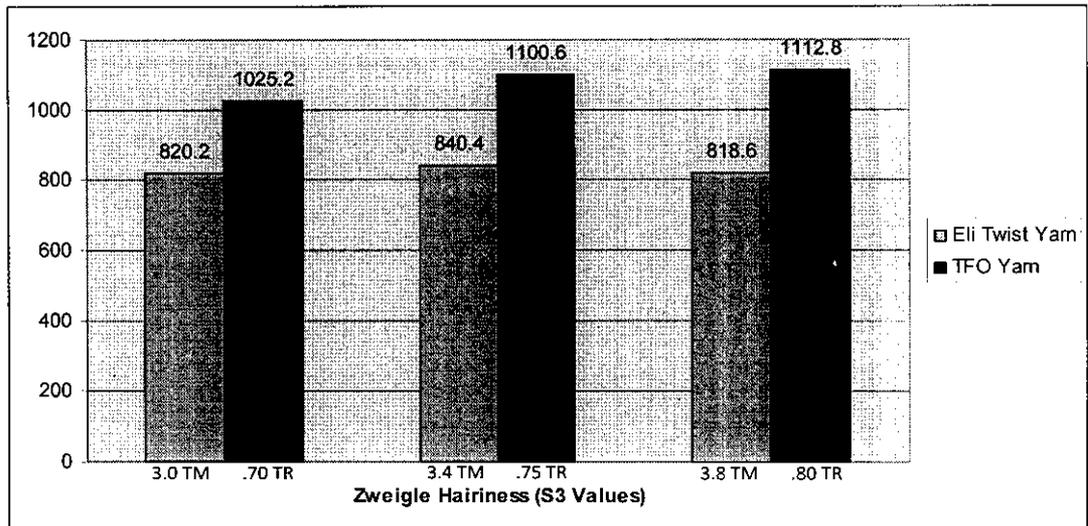
Figure 6: 2/20s Rkm Values of Eli Twist and TFO Yarns

Single yarn strength (RKM) values of Eli Twist doubled yarns are higher by 6% than the TFO doubled yarns

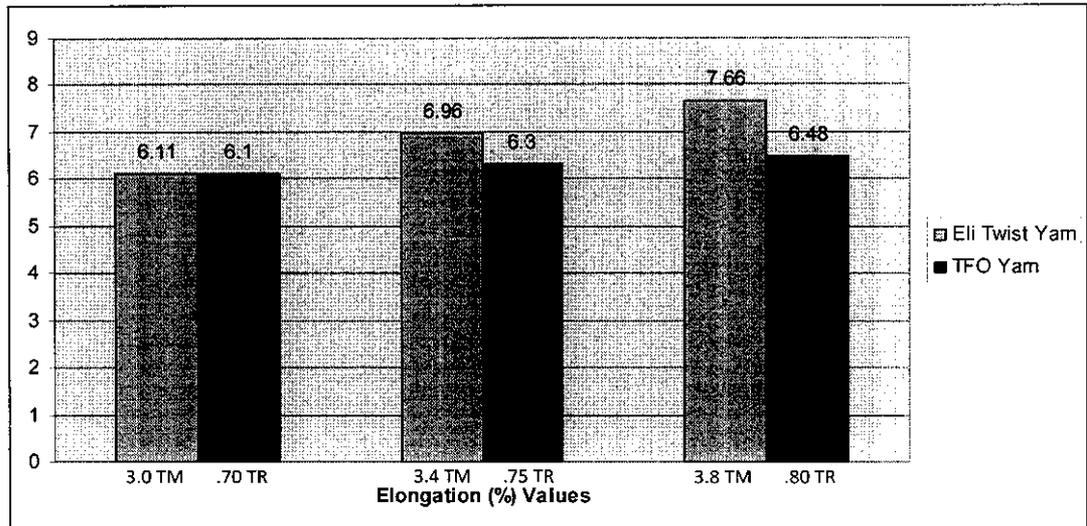
Figure 7 : 2/40s Uster Hairiness (H Value) of Eli Twist and TFO Yarns



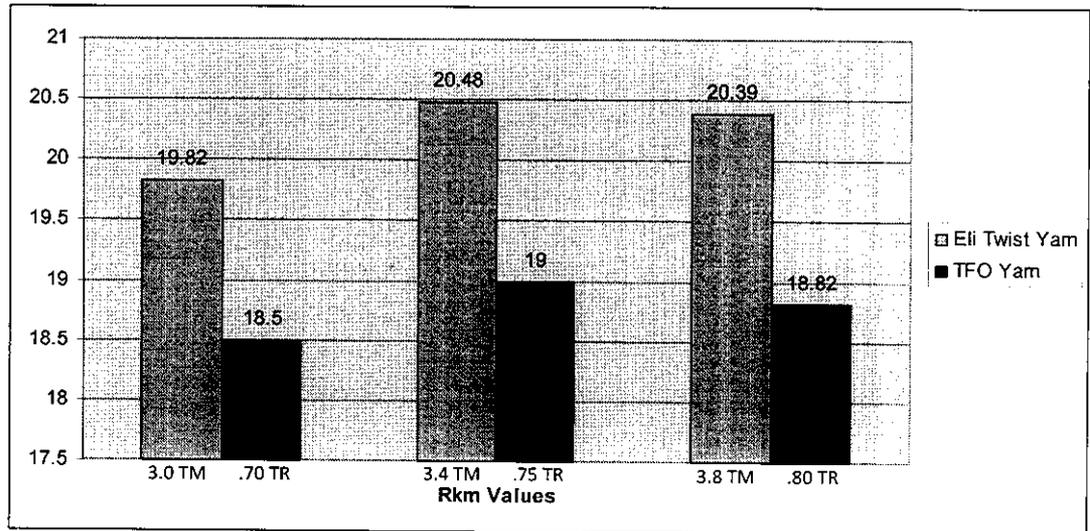
Uster Hairiness(H) of Eli Twist doubled yarns are better by 34% compare to TFO doubled yarns

Figure 8 : 2/40s Zweigle Hairiness (S3 Value) of Eli Twist and TFO Yarn

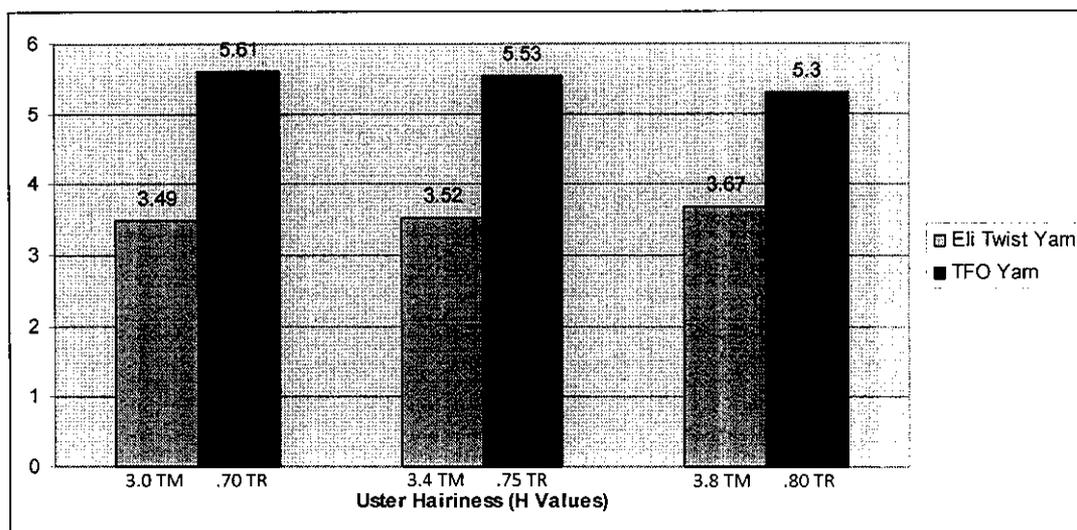
Zweigle Hairiness(S3 Value) of Eli Twist doubled yarns are better by 20-25% compare to TFO doubled yarns

Figure 9 : 2/40s Elongation (%) of Eli Twist and TFO Yarns

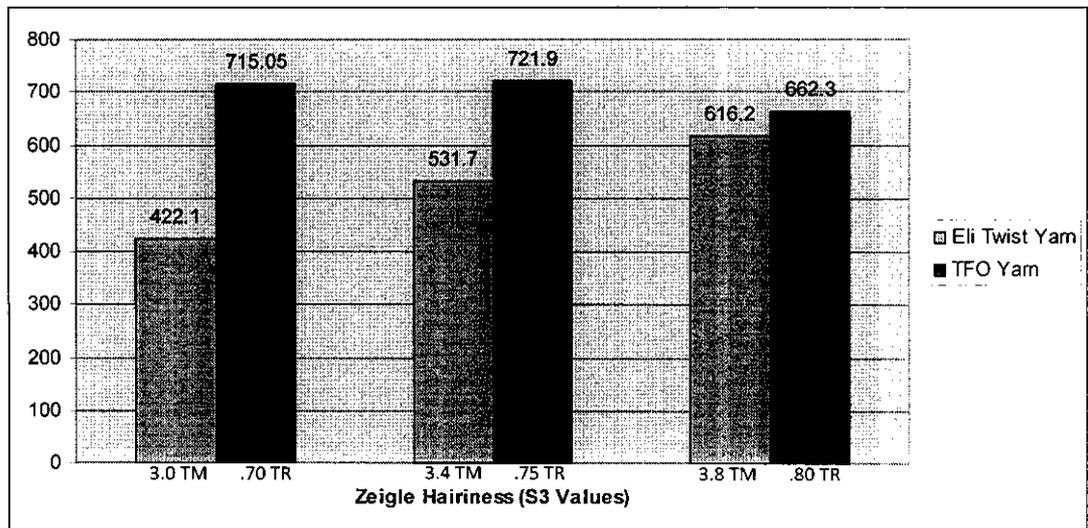
Elongation (%) values of Eli Twist doubled yarns are higher by 9-12% compare to TFO doubled yarns

Figure 10 : 2/40s Rkm Values of Eli Twist and TFO Yarns

Single yarn strength (RKM) values of Eli Twist doubled yarns are higher by 6-7.5% than the TFO doubled yarns

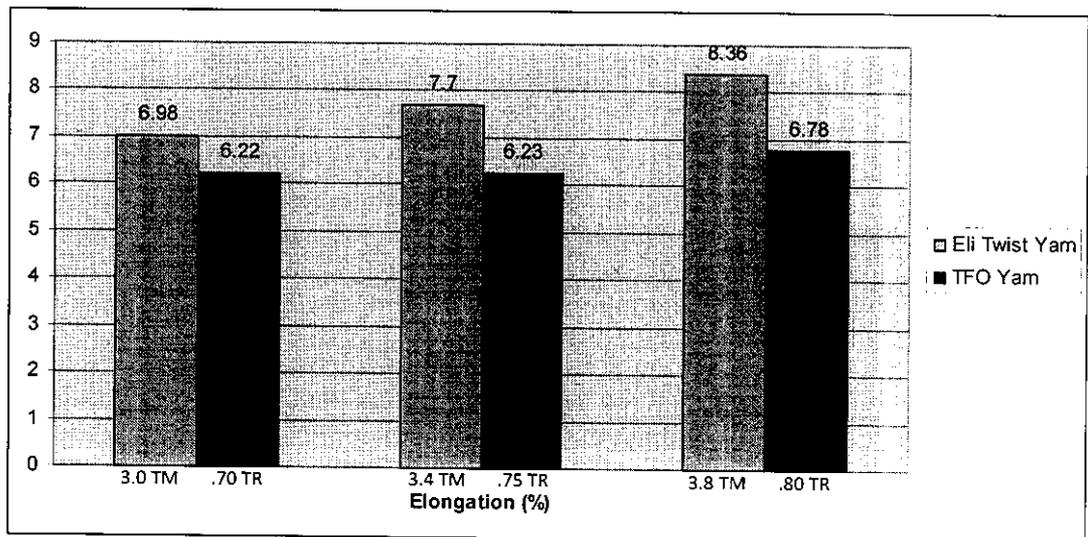
Figure 11 : 2/60s Uster Hairiness (H Value) of Eli Twist and TFO Yarns

Uster Hairiness(H) of Eli Twist doubled yarns are better by 30-37% compare to TFO doubled yarns

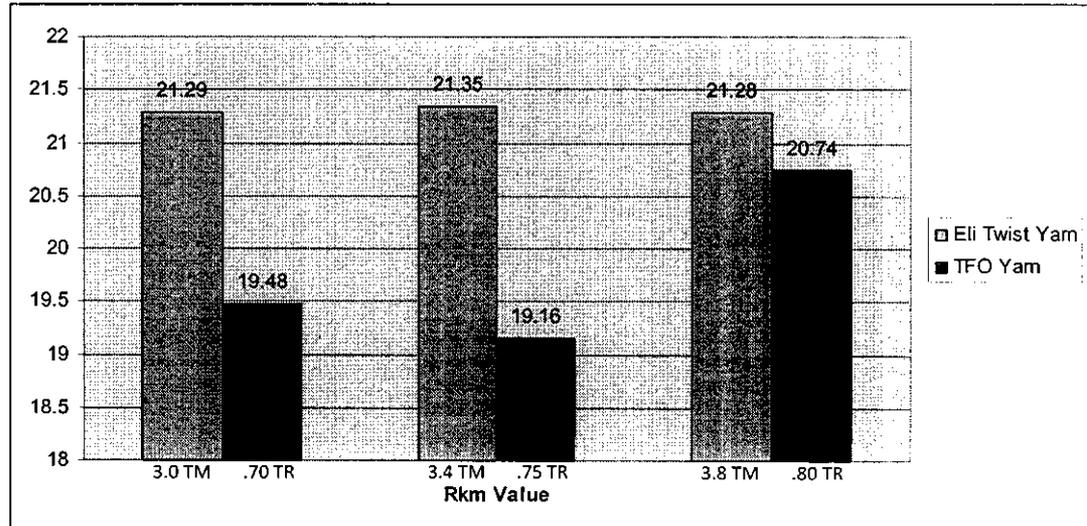
Figure12 : 2/60s Zweigle Hairiness (S3 Value) of Eli Twist and TFO Yarn

Zweigle Hairiness(S3 Value) of Eli Twist doubled yarns are better by 7-40% compare to TFO doubled yarns

Figure 13 : 2/60s Elongation (%) of Eli Twist and TFO Yarns

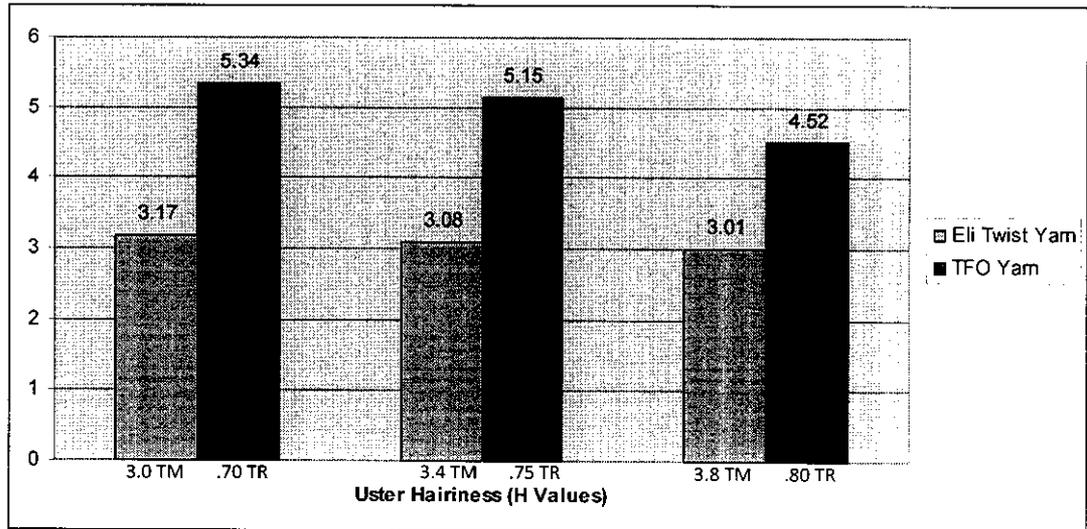


Elongation (%) values of Eli Twist doubled yarns are higher by 10-18% compare to TFO doubled yarns

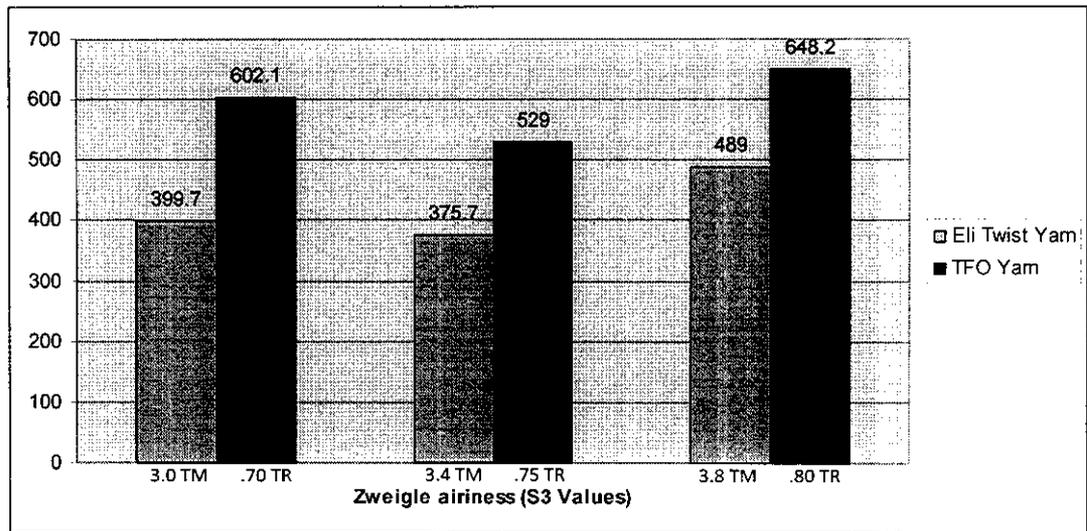
Figure 14 : 2/60s Rkm Values of Eli Twist and TFO Yarns

Single yarn strength (RKM) values of Eli Twist doubled yarns are higher by 8% than the TFO doubled yarns

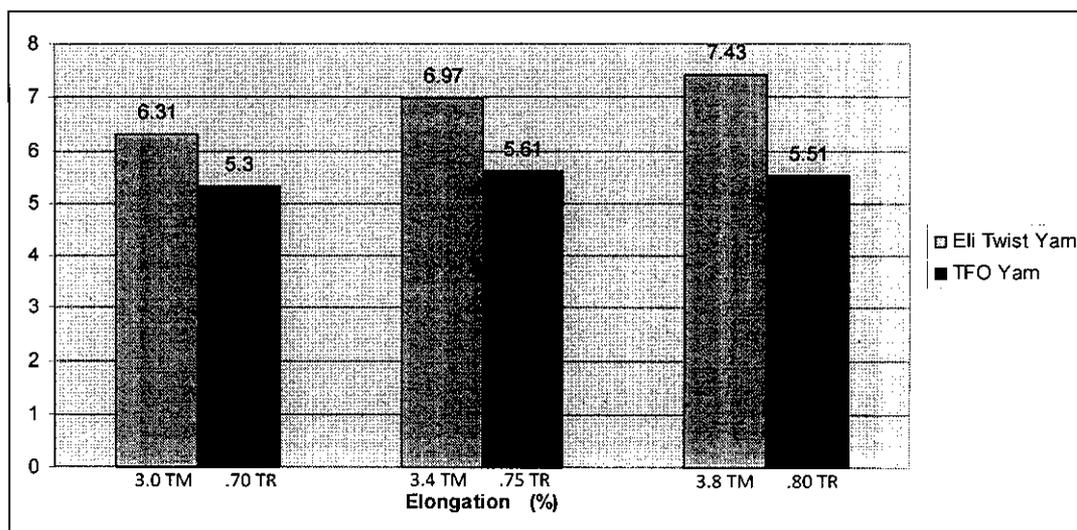
Figure 15 : 2/80s Uster Hairiness (H Value) of Eli Twist and TFO Yarns



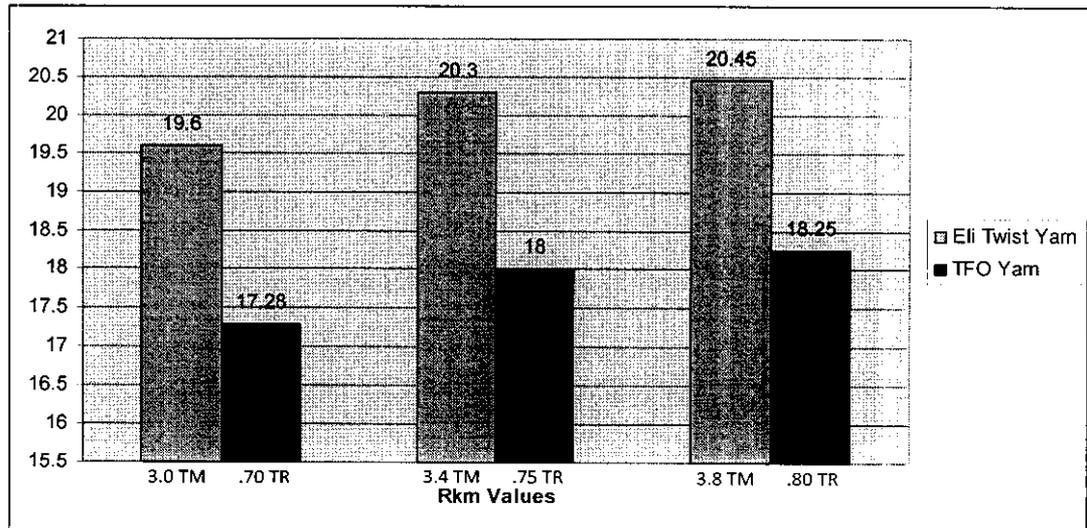
Uster Hairiness(H) of Eli Twist doubled yarns are better by 33-40% compare to TFO doubled yarns

Figure16 : 2/80s Zweigle Hairiness (S3 Value) of Eli Twist and TFO Yarn

Zweigle Hairiness(S3 Value) of Eli Twist doubled yarns are better by 24-33% compare to TFO doubled yarns

Figure 17 : 2/80s Elongation (%) of Eli Twist and TFO Yarns

Elongation (%) values of Eli Twist doubled yarns are higher by 16-25% compare to TFO doubled yarns

Figure 18 : 2/80s Rkm Values of Eli Twist and TFO Yarns

Single yarn strength (RKM) values of Eli Twist doubled yarns are higher by 11% than the TFO doubled yarns

5.1 TECHNO ECONOMICS OF ELITWIST AND TFO YARNS

TABLE 6 : TECHNO ECONOMICS OF ELI TWIST AND TFO YARNS

Particulars	Elitwist	TFO
Count	2/80s C	2/80s C
Resultant Count	40s	40s
Spindle Speed (rpm)	16500	11500
TPI	24.0	24.0
Production/day (kgs.)	340	81

1. Production of Eli Twist yarn per day is four times higher than the production of TFO of same count.
2. Approximately 4 nos. of TFO machines are required to produce 340 kgs/day which means an additional investment of Rs. 52 lakhs plus Assembly winder cost of Rs. 3 lakhs.
3. Eli Twist investment with the attachment cost comes around approximately Rs. 35 lakhs for 1008 spindles which means a saving of around Rs. 16.00 lakhs.
4. Power cost for TFO doubled yarn is roughly two times higher than the Eli Twist produced doubled yarns.

5.2 ADVANTAGES OF ELI TWIST YARNS

- Increased yarn strength up to 25%.
- Increased work capacity up to 50%.
- Reduced hairiness up to 85% (zweigle s3 fibres >3mm).
- Reduced hairiness up to 30% (uster H).
- Improved imperfection values.
- Reduction in yarn twist up to 10%.
- Reduced ends-down rate up to 60%.
- Fibre loss reduced by up to 0.01%.
- Substantially improved spinning stability.

5.3 BENEFITS IN THE DOWN STREAMS PROCESS:

- With less hairiness yarn your machine will experience less contamination.
- Weaving production will increase by up to 15%.
- See enhanced machine efficiency in knitting.
- Twist insertion into plied yarn will reduced by up to 20%.
- Same up to 50% in sizing agent.
- Up to 40% over ends down rate in warp and west.
- In many cases singeing can be dispensed with improved hand and lustre in the final product.
- Reduced abrasion.
- Experience fewer needle breaks.
- Sub statute for plied yarns.
- Improved pilling behaviour, crease resistant.

CHAPTER 6

CONCLUSION

In this project of comparing the yarn properties of Eli Twist and TFO doubled yarns, the following are the observations:

1. Uster Hairiness Index (H) of Eli Twist doubled yarns are better by 27% in 2/20s, 34% in 2/40s and 37% in 2/60s and 2/80s than the TFO doubled yarns.
2. Zweigle Hairiness Values (S3) of Eli Twist doubled yarns are better by 8% in 2/20s, 20-25% in 2/40s and 35 – 40% in 2/60s and 2/80s counts than the TFO doubled yarns.
3. Elongation values of Eli Twist doubled yarns are higher by 6 in 2/20s, 9% in 2/40s and 10-20% in 2/60s and 2/80s than the TFO doubled yarns
4. Single yarn strength (Rkm) values are higher by 6 – 11% in Eli Twist yarns of all the counts than the TFO doubled yarns.
5. Friction values of yarn spun from Eli TYwist and TFO doubled yarns do not have marked difference.
6. The techno economics of yarns produced out of Eli Twist method reveals a good saving potential than the TFO yarns.

CHAPTER 7

APPENDIX

COUNT ;2/20 C Ne

One-way ANOVA: H VALUE versus TM

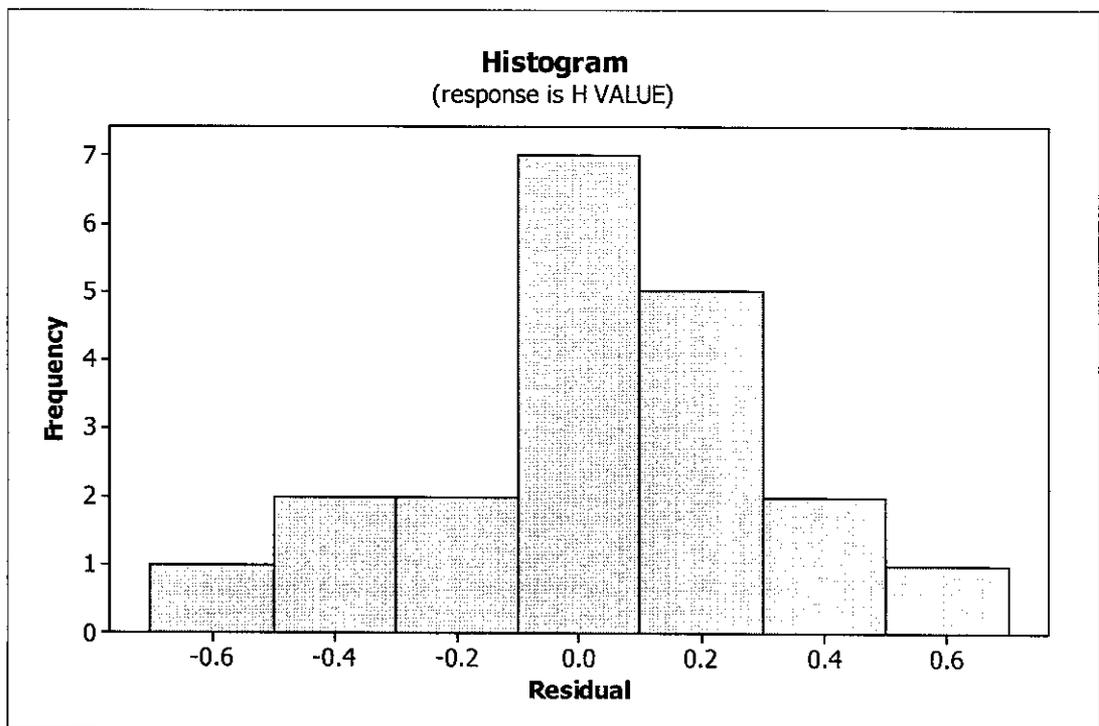
Source	DF	SS	MS	F	P
TM	1	24.9985	24.9985	296.46	0.000
Error	18	1.5178	0.0843		
Total	19	26.5163			

S = 0.2904 R-Sq = 94.28% R-Sq(adj) = 93.96%

Level	N	Mean	StDev	Individual 95% CIs For Mean Based on Pooled StDev
1	10	8.2300	0.1698	(---*---)
2	10	5.9940	0.3739	(---*---)

6.30 7.00 7.70 8.40

Pooled StDev = 0.2904



INFERENCE:

F Table Value for DF^1V_{18} : 4.41

Calculated value: 296.46

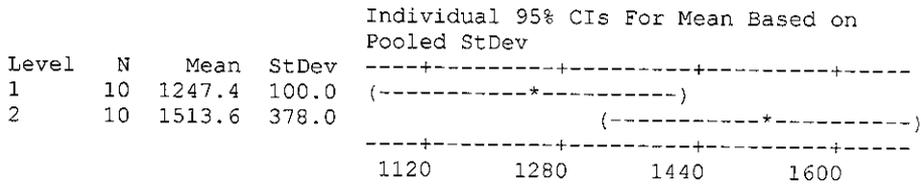
Since calculated value is greater than table value, the difference is Significant

COUNT:2/20s C Ne (A)

One-way ANOVA: S3 Value versus TM

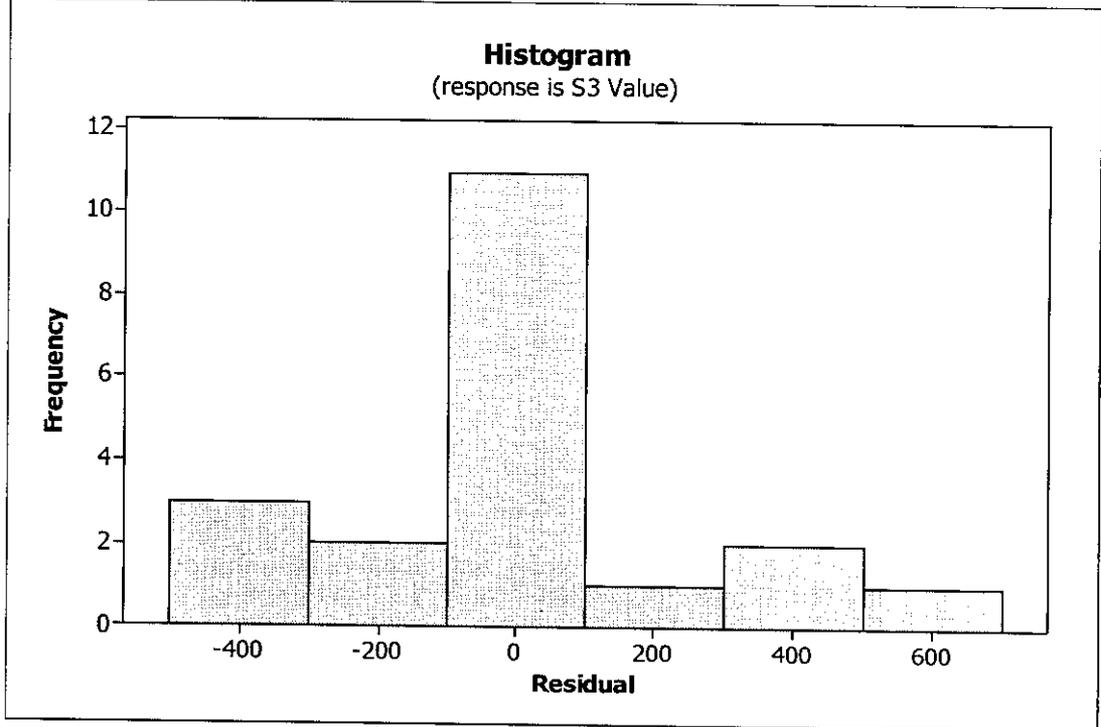
Source	DF	SS	MS	F	P
TM	1	354312	354312	4.64	0.045
Error	18	1375949	76442		
Total	19	1730261			

S = 276.5 R-Sq = 20.48% R-Sq(adj) = 16.06%



Pooled StDev = 276.5

Residual Histogram for S3 Value



INFERENCE:

F Table Value for DF^1V_{18} : 4.41

Calculated value: 4.64

Since calculated value is greater than table value, the difference is Significant

COUNT:2/20s CNe(A)

One-way ANOVA: ELONGATION versus TM

Source	DF	SS	MS	F	P
TM	1	5.3354	5.3354	178.17	0.000
Error	18	0.5390	0.0299		
Total	19	5.8745			

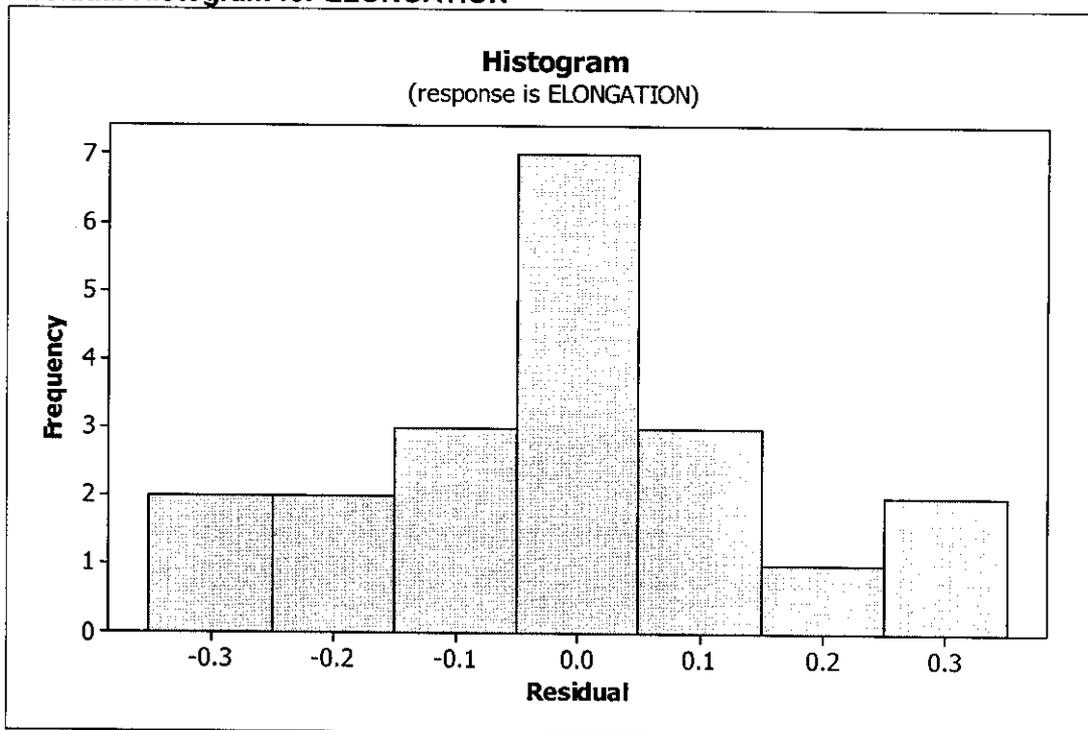
S = 0.1730 R-Sq = 90.82% R-Sq(adj) = 90.31%

Individual 95% CIs For Mean Based on Pooled StDev

Level	N	Mean	StDev
1	10	6.5420	0.1187
2	10	7.5750	0.2140

6.65 7.00 7.35 7.70

Pooled StDev = 0.1730

Residual Histogram for ELONGATION

INFERENCE:

F Table Value for DF^1V_{18} : 4.41

Calculated value: 178.17

Since calculated value is greater than table value, the difference is Significant

COUNT:2/20s C (A)

One-way ANOVA: RKM versus TM

Source	DF	SS	MS	F	P
TM	1	4.427	4.427	8.75	0.008
Error	18	9.106	0.506		
Total	19	13.533			

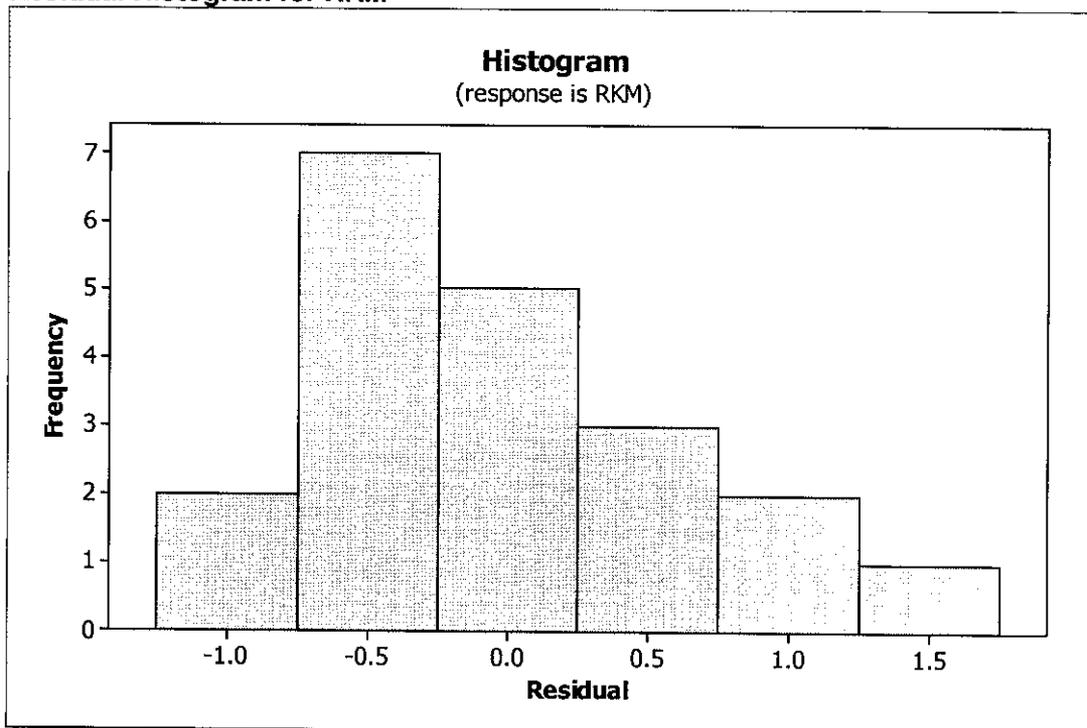
S = 0.7112 R-Sq = 32.72% R-Sq(adj) = 28.98%

Individual 95% CIs For Mean Based on Pooled StDev

Level	N	Mean	StDev
1	10	20.460	0.770
2	10	19.519	0.647

19.50 20.00 20.50 21.00

Pooled StDev = 0.711

Residual Histogram for RKM

INFERENCE:

F Table Value for DF^1V_{18} : 4.41

Calculated value: 8.75

Since calculated value is greater than table value, the difference is Significant

CHAPTER 8

REFERENCES

1. Suessen publication on Elite Compact drafting system for G5/1 and LR6 ring spinning frames.
2. Suessen publication on Elite compact set V5 and Elitwist compact set V5.
3. Sitra focus on Two for one twisting September 1997.
4. An outline at statistical methods for use in the textile industry published by Wira 1974. A Brealey, D.R.Cox.
5. WWW.Elitwist.com